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(54) **A device for a braking and traction test of a wheel comprising a rim and a tyre**

Vorrichtung zur Brems- und Antriebsprüfung eines Rades mit Felge und Reifen

Dispositif d'essai de freinage et de traction d'une roue comprenant une jante et un pneu

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Description

[0001] The present invention relates to a device for a braking and traction test of a wheel comprising a rim and a tyre.

[0002] One of the characteristic parameters of a tread of a tyre is the longitudinal stiffness per unit of length Cp of the tread under the contact area with the road. This parameter is calculated starting from a concentrated parameter constituted by the total longitudinal stiffness Ckx of a "brush model" that simulates the tread in the contact area a: (Ckx = $2a^2$à Cp). In order to determine the total longitudinal stiffness Ckx, the tyre is subjected to a braking test with a dynamometric carriage, also known as a "braking carriage".

[0003] The carriage, on which there is mounted a wheel comprising the tyre under test, is moved by a vehicle, from which the braking action on the carriage is operated, along a suitable very smooth track, made of marble tiles. On the wheel there are mounted two load cells for measuring the longitudinal force, that arises when a braking torque is applied to the wheel. On the same wheel there is also mounted a speed transducer (phonic wheel), in order to measure its angular speed. A Paiseler wheel is mounted on the vehicle, for measuring the forward speed of the carriage. There is mounted on the carriage a system for the acquisition of signals of force and of slipping speed coming from the carriage, which are transmitted by telemetering means to a control tower. The slipping speed of the tyre means the difference between the forward speed of the carriage and the peripheral speed of the tyre.

[0004] The test consists in applying a "random" braking torque (so as to have the widest possible frequency content and to take into account the fact that longitudinal stiffness varies with frequency) and in determining the transfer function between the signals of longitudinal force at the hub of the wheel (output), and the slipping movement of the tyre (input). The limit, for a frequency tending to zero, of the transfer function between longitudinal force and slipping movement, is the total longitudinal stiffness Ckx of the tread under the contact area. The longitudinal stiffness per unit of length of the tread Cp is given by the ratio Ckx/$2a^2$à.

[0005] This test with the braking carriage is fairly critical because it is performed on a track located outdoors, where the causes of error of the results are more difficult to identify and where the tests are influenced by environmental conditions and by the state of conservation of the track.

[0006] The object of the present invention is a device for a braking and traction test of a tyre that gives accurate and repeatable results and makes it easy to perform the test.

[0007] The above mentioned object is attained, according to the invention, by a device for a braking and traction test of a wheel comprising a rim and a tyre, integral with a hub that is free to rotate, said device comprising a road-wheel rotating at preselected speeds, a crank integral with said hub, a connecting rod connected by means of a pivot to said crank and by means of a pin to a piston sealingly sliding in a chamber of a cylinder containing air, closed by a head, first deformation transducer means associated with said hub, capable of measuring the longitudinal force transmitted by said tyre to said hub, second and third speed transducer means associated with said hub and with said road-wheel, respectively, capable of measuring the slipping speed of said tyre, said tyre being caused to rotate by said road-wheel and driving said piston, through said crank and connecting rod, to execute a reciprocating movement inside said cylinder performing a compression stroke and an expansion stroke of said air in said chamber so as to exert on said wheel and on said tyre a sinusoidal torque consisting in a braking torque during said compression stroke and in a traction torque during said expansion stroke.

[0008] The device according to the invention enables to perform the braking tests of a tyre indoors instead of outdoors, as is the case with the traditional dynamometric carriage. Thus, the tests can be run more easily and they provide measures with a degree of accuracy that is higher than those performed with the dynamometric carriage. Moreover, the causes of noise of the experimental signals can be identified more easily.

[0009] The test consists in applying a sinusoidal torque of suitable amplitude, with a frequency ranging from 0.1 to 25 Hz, and in determining the transfer function between the signals of longitudinal force at the hub of the wheel (output) and the slipping speed of the tyre (input), meaning the difference between the peripheral speed of the road-wheel and the peripheral speed of the tyre. The limit, for a frequency tending to zero, of the transfer function between longitudinal force and slipping movement, is the total longitudinal stiffness Ckx of the tread under the contact area.

[0010] In this indoor test, there is the advantage of a greater accuracy in measuring the value of the longitudinal force at low frequencies (0.1 Hz).

[0011] The longitudinal stiffness per unit of length of the tread Cp, is given by the ratio Ckx/$2a^2$à. Since this stiffness is a function of the tread mixture, as well as of the design, it follows that the stiffness is a function of the frequency and this is taken into account in the "brush model" designed by the Applicant.

[0012] Features and advantages of the invention will now be illustrated with reference to embodiments represented as non-limiting examples in the enclosed figures, wherein:

Fig. 1 shows diagramatically a device for a braking and traction test of a wheel comprising a rim and a tyre, made according to the invention;

Fig. 2 is a graph showing the curve of a transfer function between longitudinal force and slipping speed against the frequency, observed on a wheel subjected to a braking test with the device of Fig. 1.

[0013] There is shown in Fig. 1 a device for a braking and traction test made according to the invention. The device comprises a road-wheel 1 caused to rotate at preselected speeds by an electric motor, not shown, a wheel 2, comprising, in turn, a rim 3 and a tyre 4, caused to rotate by the road-wheel 1, and a dynamometric hub 5 made integral with the rim 3 of the wheel 2 and free to rotate, being rotatably supported by a base, not shown. The device also comprises a crank 6, integral with the hub 5, and a connecting rod 7 that has one end (head) connected by means of a pivot 8 to the crank 6 and another end (foot) connected by means of a pin 9 to a piston 10 sealingly sliding in a chamber 11 of a cylinder 12 containing air, closed by a head 18. The stiffness of the air inside the chamber 11 is shown diagramatically by a spring 16. A transducer of deformation 13, fastened to the hub 5, measures the longitudinal force transmitted by the wheel 2 to the hub 5 and two transducers of angular speed 14 and 15, fastened to the hub 5 and to a hub (not shown) of the road-wheel 1, respectively, measure the slipping speed of the tyre 4. The transducers of angular speed 14 and 15 consist of high-resolution encoders (accuracy to one thousandth).

[0014] With the device it is possible to provide a braking torque and a traction torque to the wheel 2 with the tyre 4. The wheel 2 is urged radially against the road-wheel 1 by a preselected vertical force applied to the hub 5 that represents the share of the weight of a vehicle bearing on a wheel. The road-wheel 2 causes the rotation of the tyre 4, which through the crank 6 and the connecting rod 7 causes the piston 10 to move with a reciprocating motion to perform a compression stroke and an expansion stroke. When the piston 10 is in the compression stroke, through the connecting rod 7 and the crank 6, the wheel 2 with the tyre 4 is braked, while when the piston 10 is in the expansion stroke the wheel 2 is accelerated.

[0015] The signals detected by means of the transducers 13, 14 and 15 are the longitudinal force at the dynamometric hub 5 and the slipping speed meaning the difference between the peripheral speed of the road-wheel 1 and the peripheral speed of the tyre (with no torque on the tyre the slipping speed is zero).

[0016] There is a shown in Fig. 2 the curve of a transfer function consisting of the ratio F/s between the signals of longitudinal force at the hub of the wheel (output) and the slipping speed of the tyre (input) (kg/%) against the frequency f (Hz) of the sinusoidal torque applied by the piston 10 to the wheel 2, for a tyre P6000 185/60 R14 having an inflation pressure p = 2 bar, at a speed of the road-wheel of 50 km/h. The limit, for a frequency tending to zero (dashed line in Fig. 2), of the transfer function between longitudinal force and slipping movement, is the total longitudinal stiffness Ckx of the tread under the contact area.

Claims

1. A device for a braking and traction test of a wheel (2) comprising a rim (3) and a tyre (4), integral with a hub (5) that is free to rotate, said device comprising a road-wheel (1) rotating at preselected speeds, a crank (6) integral with said hub (5), a connecting rod (7) connected by means of a pivot (8) to said crank (6) and by means of a pin (9) to a piston (10) sealingly sliding in a chamber (11) of a cylinder (12) containing air, closed by a head (18), first deformation transducer means (13) associated with said hub (5), capable of measuring the longitudinal force transmitted by said tyre (4) to said hub (5), first and second speed transducer means (14, 15) associated with said hub (5) and with said road-wheel (1), respectively, capable of measuring the slipping speed of said tyre (4), said tyre (4) being caused to rotate by said road-wheel (1) and driving said piston (10), through said crank (6) and connecting rod (7), to execute a reciprocating movement inside said cylinder (12) performing a compression stroke and an expansion stroke of said air in said chamber (11) so as to exert on said wheel (2) and on said tyre (4) a sinusoidal torque consisting in a braking torque during said compression stroke and in a traction torque during said expansion stroke.

Patentansprüche

1. Vorrichtung für einen Brems- und Traktionsversuch eines Rades (2), das eine Felge (3) und einen Reifen (4) aufweist, die ein Stück mit einer frei drehbaren Nabe (5) bilden, wobei die Vorrichtung eine die Straße bildendes Rad (1), das sich mit vorher ausgewählten Drehzahlen dreht, einen Kurbelarm (6), der ein Stück mit der Nabe (5) bildet, eine Verbindungsstange (7), die mittels eines Gelenks (8) mit dem Kurbelarm (6) und mittels eines Zapfens (9) mit einem Kolben (10) verbunden ist, der abdichtend in einer von einem Kopf (18) verschlossenen

Kammer (11) eines Luft enthaltenden Zylinders (12) gleitend verschiebbar ist, eine erste Verformungswandlereinrichtung (13), die der Nabe (5) zugeordnet ist und in der Lage ist, die Längskraft zu messen, die von dem Reifen (4) auf die Nabe (5) übertragen wird, und eine erste und eine zweite Geschwindigkeitswandlereinrichtung (14, 15) aufweist, die der Nabe (5) bzw. dem die Straße bildenden Rad (1) zugeordnet und in der Lage sind, die Rutschgeschwindigkeit des Reifens (4) zu messen, wobei der Reifen zum Drehen durch das die Straße bildende Rad (1) gebracht wird und den Kolben (10) über den Kurbelarm (6) und die Verbindungsstange (7) so antreibt, daß dieser innerhalb des Zylinders (12) eine Hin- und Herbewegung und dabei einen Kompressionshub und einen Expansionshub der Luft in der Kammer (11) ausführt, wodurch auf das Rad (2) und auf den Reifen (4) ein sinusförmiges Drehmoment ausgeübt wird, das während des Kompressionshubs aus einem Bremsdrehmoment und während des Expansionshub aus einem Traktionsdrehmoment besteht.

Revendications

1. Dispositif d'essai de freinage et de traction d'une roue (2) comprenant une jante (3) et un pneu (4), liée à un moyeu (5) qui est libre de tourner, ledit dispositif comprenant une roue-route (1) tournant à des vitesses présélectionnées, une manivelle (6) liée audit moyeu (5), une tige de connexion (7) connectée au moyen d'un pivot (8) à ladite manivelle (6) et au moyen d'un axe (9) à un piston (10) coulissant de manière étanche dans une chambre (11) d'un cylindre (12) contenant de l'air, fermée par une calotte (18), un premier transducteur de déformations (13) associé audit moyeu (5), capable de mesurer la force longitudinale transmise par ledit pneu (4) audit moyeu (5), un premier et un second transducteur de vitesse (14, 15) associés respectivement audit moyeu (5) et à ladite roue-route (1), capables de mesurer la vitesse de glissement dudit pneu (4), ledit pneu (4) étant mis en rotation par ladite roue-route (1) et entraînant ledit piston (10), au moyen de ladite manivelle (6) et de ladite tige de connexion (7), pour exécuter un mouvement de va-et-vient à l'intérieur dudit cylindre (12) réalisant un temps de compression et un temps de détente dudit air contenu dans ladite chambre (11) afin d'exercer sur ladite roue (2) et sur ledit pneu (4) un couple sinusoïdal constitué d'un couple de freinage pendant ledit temps de compression et d'un couple de traction pendant ledit temps de détente.

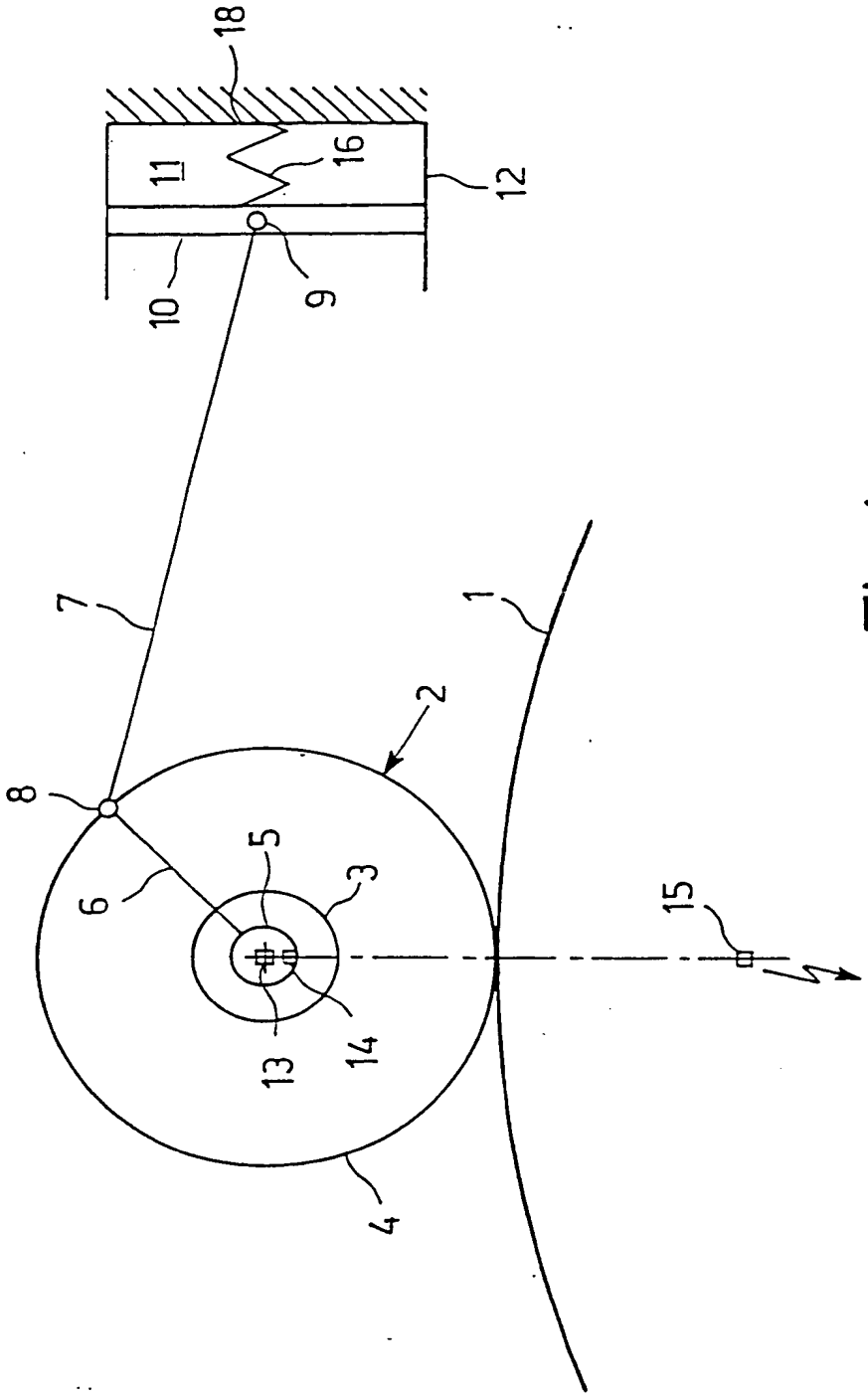

Fig.1

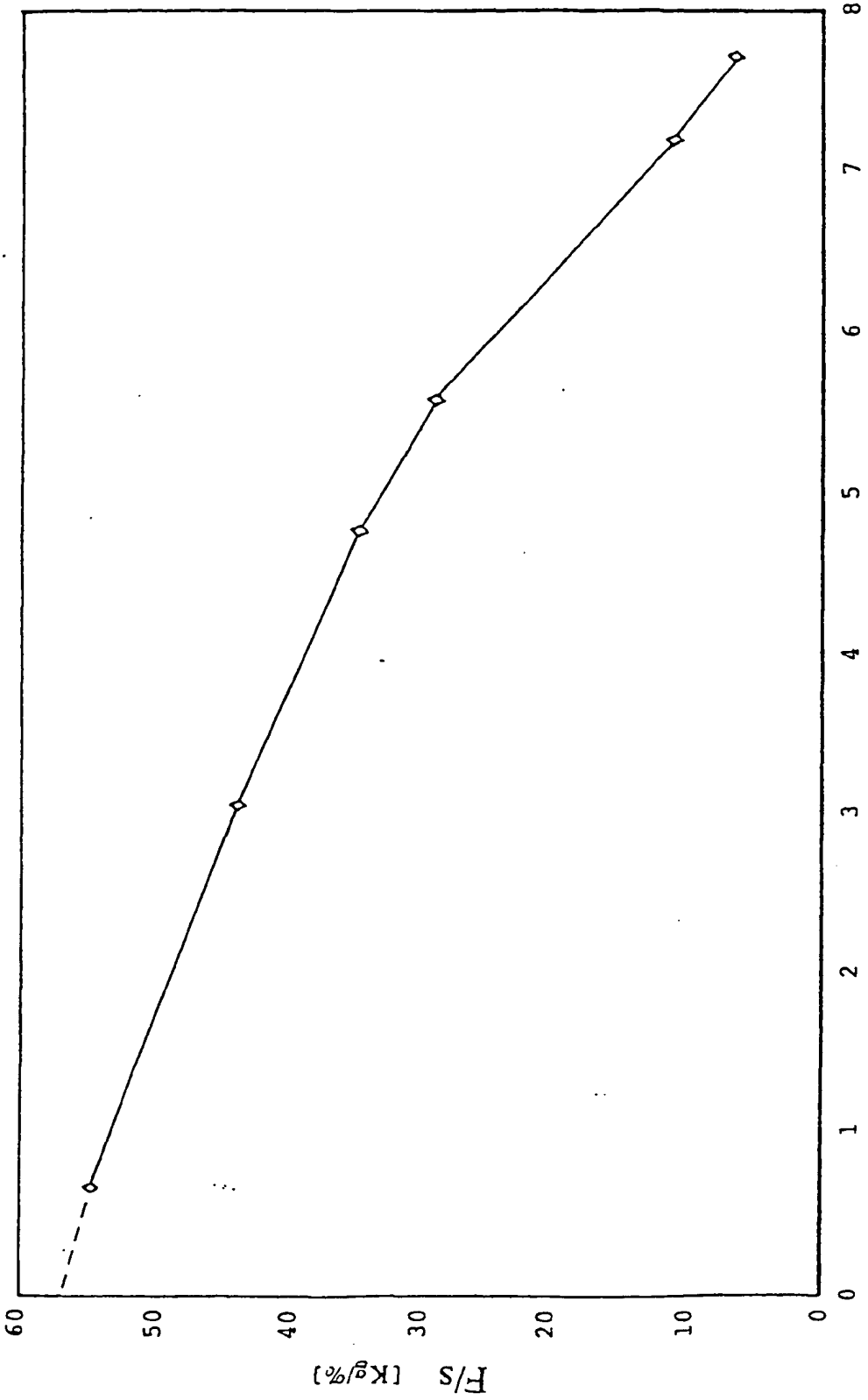

Fig.2

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(54) SIGNAL TRANSMISSION DEVICE FOR ELEVATOR

(57) Abstract:

PURPOSE: To reduce a coupling loss between a close cable and a coupler due to movement of car during traveling, inclination by uneven load, etc., in a close coupling transmission system in which the signal transmission between a machine room and a car is carried out, using weak radio wave by eliminating tail cord between the machine room of an elevator and the car and reducing the tail cord.

CONSTITUTION: An exclusive-guide device is installed on a coupler 3 to provide a structure in which the coupler travels while holding a guide rail pressingly, and the coupler 3 is supported on a car through a damper 12. Also a close cable 4 is installed through the guide rail 2. Thus, because the vibration and inclination of the car are absorbed by the damper, the close coupling of the close cable with the coupler can be stabilized.